

**1. INFLUENCE OF THE PROTON
CONCENTRATION ON THE PROPERTIES OF
THE LiNbO₃ and LiTaO₃ CRYSTALS**

Interim report 2

by

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September 1996

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London England

CONTRACT NUMBER : N68171-96-C-9040

R&D 7774-EE-01

DTIC QUALITY INSPECTED 3

19970506
690 900901669

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Fabrication of Proton exchanged waveguides

Since June, we have started to prepare PE waveguides with different recipes, in order to get waveguides presenting the different crystallographic phases identified in LiNbO₃. Those samples have been characterized optically, and we have been facing the problem of a rather poor reproducibility. On step index waveguides we measured up to 10% fluctuation on the index increase of samples prepared with the same recipe. For the samples presenting graded index profiles, the situation was even worse, as it was not always possible to avoid the formation of a surface layer presenting a high index increase and a step profile.

After different investigation, we have been able to demonstrate that these fluctuations were due to a non controlled amount of water incorporated in the benzoic acid -lithium benzoate mixture we use as a proton source. Improving this control allowed us to reduce the fluctuations of the index increase in the case of the step index profiles down to 1%. We are now building a suitable equipment to achieve a good control of the water amount in the melt, and of course this has slightly delayed the preparation of the samples.

Influence of the Proton exchanged process on the nonlinearity

Despite the reproducibility problems, some preliminary experiment aiming at measuring the nonlinear coefficient of different exchanged layers have been performed. They have shown dramatic differences depending on the recipe. In order to conclude more precisely, the spatial resolution of the nonlinear experiment has to be improved (this is currently done) and the samples have to be tested by X-rays and SIMS.

Influence of the Proton exchanged process on the poling

In this field also, preliminary experiment have demonstrated a great potential. Indeed, doing some proton exchange allows to significantly modify the poling field of the crystal. This has been demonstrated for large areas on the substrate. In order to be able to use this property to pattern the poling, we have now to study in more details the spatial behavior of the domains in PE exchanged substrates.

REPORT DOCUMENTATION PAGE			
1. AGENCY USE ONLY	2. REPORT DATE 09/30/96	3. REPORT TYPE AND DATES COVERED July - September 96	
4. TITLE : Influence of the proton concentration on the properties of the LiNbO ₃ and LiTaO ₃ crystals		5. FUNDING NUMBERS	
6. AUTHOR : M.P. DE MICHELI			
7. PERFORMING ORGANIZATION NAMES AND ADDRESSES Laboratories de Physique de la Matière Condensée, Parc Valrose, 06108 NICE Cedex 2 , FRANCE		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING, MONITORING AGENCY NAMES AND ADDRESSES		10. SPONSORING, MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12A. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; distribution unlimited.		12B. DISTRIBUTION CODE	
13. ABSTRACT Preparing series of waveguides with the same recipe, we faced the problem of a rather poor reproducibility (up to 10% fluctuation of the index increase for step index waveguides). We were able to demonstrate that this phenomenon was due to an uncontrolled amount of water in the melt we used for the exchange. Preliminary experiment have been performed to test the influence of the Proton Exchange on the nonlinearity of the crystal and on its poling behavior. In both cases, an important influence has been observed.			
14. SUBJECT TERMS		15. NUMBER OF PAGES	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF THE REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT